ADSL2+ MODEMS: the authoritative speed test

Fourteen hardware manufacturers, 23 modems, 1km, 3.5km and 6km lengths of copper phone line, 1 DSLAM, 1 ISP test lab and numerous technical experts. *Dan Warne* put them all together to discover this simple fact: some ADSL2+ modems are dramatically faster than others.

THE players twenty three TESTED

VENDOR	MODEL	PRICE	ONLINE	PHONE
1. Belkin	F1PI241EGau	$299.95	www.belkin.com/anz	1800 235 546
2. Billion	7404VGP	$299.00	www.billion.com.au	(08) 8322 9544
3. Billion	7300G	$169.00	www.billion.com.au	(08) 8322 9544
4. Cisco	877W	$1,622	www.cisco.com.au	(02) 8446 6000
5. D-LINK	DSL-504T	$129.95	www.dlink.com.au	(02) 8899 1800
6. D-LINK	DVA-G3340S	$299.00	www.dlink.com.au	(02) 8899 1800
7. DrayTek	Vigor2800VG	$399.95	www.draytek.com.au	(02) 9643 9989
8. Dynalink	RTA1046VW	$299.00	www.dynalink.com.au	1800 653 962
9. Dynalink	RTA1335	$129.00	www.dynalink.com.au	1800 653 962
10. LevelOne	FBR-1416A (v2)	$119.95	www.levelone.com.au	1800 617 711
11. LevelOne	WBR-3407A (v2)	$164.95	www.levelone.com.au	1800 617 711
12. Linksys	AG241	$139.95	www.linksys.com.au	1800 678 808
13. Linksys	WAG54GP2	$299.95	www.linksys.com.au	1800 678 808
14. NetComm	NB5Plus4	$129.00	www.netcomm.com.au	(02) 9424 2070
15. NetComm	NB9W	$299.00	www.netcomm.com.au	(02) 9424 2070
16. NETGEAR	DG834 ADSL Firewall Router	$129.00	www.netgear.com.au	1800 502 061
17. OPEN Networks	iConnectAccess624	$129.00	www.opennw.com	(03) 8613 0500
18. OPEN Networks	iConnectAccess624W	$159.00	www.opennw.com	(03) 8613 0500
19. Siemens	Speedstream 6520	$249.00	www.bigpond.com	13 12 82
20. Thomson	Speedtouch ST546	$129.95	www.dvdirect.com.au/thomson	(02) 9975 2799
21. Thomson	Speedtouch ST780WL	$259.95	www.dvdirect.com.au/thomson	(02) 9975 2799
22. Zyxel	Prestige 2602HWL-61C	$289.00	www.zyxel.com.au	(02) 8745 8400
23. Zyxel	Prestige 660HW	$165.00	www.zyxel.com.au	(02) 8745 8400

DAN WARNE – NEWS AND ONLINE EDITOR

Dan Warne is *APC*'s News Editor and resident broadband guru. He has been testing and commenting on broadband since 1999, when he was connected to BigPond's broadband network, best described a 'customer experiment' at the time. Since then he has run the gauntlet of RIMs, 3GB caps, politicians on both sides, ADSL2+ modems that weren't, VoIP and wireless broadband. Before joining *APC*, he was involved in the growth of Whirlpool as News Editor.

Twelve months ago, when *APC* embarked on Australia's first published lab testing of ADSL2+ modems, we weren't prepared for the enormous variation in results that we'd see.

Some modems could sync at ADSL2+ speeds (up to 24Mbit/s), but didn't have an adequately grunty CPU to chew through data faster than about 12Mbit/s. Confusingly, the best-performing modem, Billion 7402, used the same processor (Conexant) as one of the poorest (Draytek 2800).

This year, we expanded our testing to cover two distinct categories of modem/router:
1. Budget models that only include the essentials: an ADSL2+ modem/router and four ethernet ports.
2. "All-in-ones" including an 802.11g access point, VoIP ports and (in some models) VPN access to allow a secure, direct connection to your home network from a remote location.

We also added wireless performance testing to our range of tests. With 802.11g's "54Mbit/s" performing more like 20Mbit/s in optimal conditions (and that speed dropping away rapidly as you move away from the base station), we wanted to test our concerns that wireless would lead to a bottleneck in any ADSL2+ connected home network. Unlike other publications — that have simply plugged modems into a home ADSL2+ connection of unknown line length and condition — we used the test lab of ISP Internode, with assistance from their R&D department and network experts. We had full access to their DSLAM configuration interface to monitor modem performance in detail.

HOW WE TESTED

There are two ways to test ADSL2+ modems: using an electronic phone line simulator which can be configured to inject variable amounts of noise into a line, or using real lengths of real copper wire. Though both methods have their pros and cons, we opted to test with real copper wire (the closest thing to what actually runs between your home and a Telstra exchange).

Of course, because the copper wire we were testing on was new and good quality, our results are probably a little better than what would be seen in the field. Real Telstra phone lines have to contend with moisture in pits, bridge taps (bits of unused copper wire hanging off your line) and a multitude of other problems inherent in a decaying 100-year-old network.

However, our tests were designed to give an accurate comparison of how different modems perform over various line lengths. The longer the line, the greater the background noise, as outside signals are picked up from nearby lines and radio frequency interference. In fact, because the copper phone line we tested with was batched in enormous coils, the cross-talk from the hundreds of nearby strands would have gone some of the way to simulating what happens in a Telstra main trunk line: signals leak within the fat batch of cables that runs underground from the exchange before being split up to customers' homes.

We tested at three line-lengths: 1km, 3.5km and 6km. We had access to a "Krone block" where it was possible to change the line length in 500m blocks by plugging in at a certain jumper position.

We were also able to monitor modem sync speed and line conditions via the Ericsson PEM configuration software which displayed details on the Ericsson EDN312xe DSLAM (that was pumping signal down the copper line to our modems).

We downloaded large files from a dedicated FTP server running FreeBSD to determine actual throughput. The server had 2GB RAM and an AMD Athlon 2200XP processor (and was commissioned especially for *APC*'s testing with no other users).

For the wireless testing, we tested all the modems at *APC*'s Sydney CBD offices using the established test locations that we use for other wireless router testing. Our offices are far from a "perfect" test environment (there are many wireless networks in nearby buildings and several in use on our floor). However, rather than providing "perfect lab conditions" for wireless, we wanted to get an idea of what constitutes real-life performance for the modems.

We conducted a site survey using NetStumbler and confirmed that an unused wireless channel was available. We configured all the modems to use that channel before testing.

The speed of an unencrypted wireless signal is really only useful for hotspot operators to know — home and business users want secure wireless networks. With that in mind, we tested with WPA-PSK turned on — the best level of security commonly available across all the modems. So, in addition to testing wireless signal penetration and throughput, this tested the modem CPU's ability to encrypt data at high speed.

We used the IPerf software running on a server connected by Ethernet to each modem to pump out a stream of TCP data as fast as the modem could take it. Our client machine was a Centrino-compliant Sony Vaio TX17 notebook with all power-saving features switched off.

We tested the wireless performance in three positions: about 30cm from the transmitter, about 10m away (through a wood partition, a plaster wall and a glass wall) and about 15m away (through wood, plaster, metal partitions, racks of magazines, photocopiers and other office equipment).

This Krone block allowed us to change the length of the test copper phone line in 500m increments.

The actual Ericsson DSLAMs we tested with in Internode's lab.

This high speed FreeBSD FTP server was dedicated to *APC*'s testing — to ensure server load wasn't an issue.

The back of the DSLAM where copper twisted-pair meets high-speed digital signals.

Warnie at Internode HQ

ADSL2+ speed surprises

TOP 5 at 1km

1 OPEN Networks iConnectAccess624W (15.17Mbit/s)
=1 Siemens Speedstream 6520 (15.17Mbit/s)
3 Belkin F1PI241EGau (14.96Mbit/s)
4 Billion 7300G (14.89Mbit/s)
5 Linksys WAG54GP2 (14.63Mbit/s)
Ranked on actual throughput, not line sync speed.

TOP 5 at 3.5km

1 Billion BIPAC-7300G (8.78Mbit/s)
2 Cisco 877W (8.53Mbit/s)
3 Billion BIPAC-7404VGP (8.10Mbit/s)
4 Dynalink RTA1335 (7.07Mbit/s)
5 Dynalink RTA1046VW (7.07Mbit/s)
Ranked on actual throughput, not line sync speed.

We knew from last year's testing that line sync speeds bear very little relationship to actual throughput. This was borne out again in this year's testing.

For example, the Draytek Vigor synced at 21.2Mbit/s but only achieved 8.4Mbit/s throughput at 1km — a whopping 60 per cent difference. There were other similarly bad examples, like the Thomson Speedtouch 546 at 55 per cent difference (23.1Mbit/s sync, 10.3Mbit/s throughput) and Dynalink RTA1335 at 51% difference (24Mbit/s sync, 11.7Mbit/s throughput.) In fact, the average gap between sync speed and throughput was 39 per cent.

The best modems in terms of the narrowest gap were D-Link DSL-504T (30%), D-Link DVA-G3440S (32%), Siemens Speedstream 6520 (33%), Billion 7300G (33%) and Belkin F1PI241Egau (34%). All five of these modems used slightly more conservative sync speeds of 20-22Mbit/s at 1km line length, which suggests that if your modem aims for the highest possible sync speed it could actually result in much lower actual throughput.

With such enormous disparity between sync speed and actual throughput, there's not much point paying heed to the speed at which your modem syncs with the DSLAM.

You might be surprised to see that the fastest actual transfer speed recorded was 15.2Mbit/s, despite the widely promoted maximum 24Mbit/s speed of ADSL2+. It's possible the modems could go faster if you live next to a Telstra exchange. We didn't do any 100m line-length testing as the results would be irrelevant to most readers. We did, however, notice that tweaking DSLAM settings outside of defaults could dramatically increase modem throughput (see page 58). For our main tests though, we showed the results based on the default Internode DSLAM profile assigned to all new customers, to give an idea of an "out of the box" experience.

Given the extraordinary difference in performance at each line length, you might be wondering what modem to buy since you (probably) don't know what your home phone's line length is. There's no easy way to find out, but here's a hint: before an ISP connects an ADSL2+ service they must conduct a Telstra service qualification (SQ) on your line. This tells them whether they are allowed to hook you up for ADSL2+, but along the way, it tells them detailed information about your line length, the thickness/quality of the copper cable running to your house, and so on. They may be hesitant to give the information out but if you can find a friendly sales consultant they

TOP 5 at 6km

1 Netgear DG834 (1.90Mbit/s)
=1 LevelOne WBR-3407A (1.90Mbit/s)
=1 Cisco 877W (1.90Mbit/s)
4 Belkin F1PI241EGau (1.82Mbit/s)
5 Netcomm NB5Plus4 (1.82Mbit/s)
Ranked on actual throughput, not line sync speed.

TOP 5 at 1 & 3.5km

1 Billion 7300G (11.84Mbit/s)
2 Billion 7404VGP (11.36Mbit/s)
3 Siemens Speedstream 6520 (10.97Mbit/s)
4 OPEN Networks iConnectAccess 624W (10.84Mbit/s)
5 Belkin F1PI241EGau (10.73Mbit/s)
Ranked on actual throughput, not line sync speed.

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What a difference a year makes

What was obvious in our testing of this year's modems was that some manufacturers that performed very badly last year — notably Zyxel — have been improving their performance. The same Zyxel Prestige P2602HWL that topped-out at an embarrassing 9.4Mbit/s transfer rate last year performed better this year, achieving a more respectable 13.5Mbit/s throughput (against a line sync speed of 20.1Mbit/s).

Likewise, Netcomm has sorted out the shambles that was its NB5 modem (sold as "upgradeable" to ADSL2+… which Netcomm later revealed would require a hardware upgrade with an attached fee.) To its credit, following negative publicity, Netcomm agreed to cover all costs including postage (and upgraded the modems free of charge). The NB5Plus4 variant we tested (an NB5 with four Ethernet ports) wasn't a speed demon, but it had competitive performance: it was tenth fastest at 14.4Mbit/s on the 1km line-length.

Another obvious example of performance improvement was Netgear's DG834 modem/router. Even though we asked all the modem manufacturers to submit their review samples with the latest ADSL2+ firmware installed, Netgear's DG834 came with a very old version (1.05.00). We upgraded to the latest version (3.01.25) and the modem's sync speed immediately gained 6Mbit/s. Many people probably never think to check if there's a newer version of their modem's firmware. However, modem manufacturers frequently release updates, and often the Australian branches of modem makers offer Australian firmware versions that are tweaked to match the characteristics of the most widely deployed ADSL2+ DSLAMs in Australian ISPs.

MODEMS THAT WE CAN'T RECOMMEND

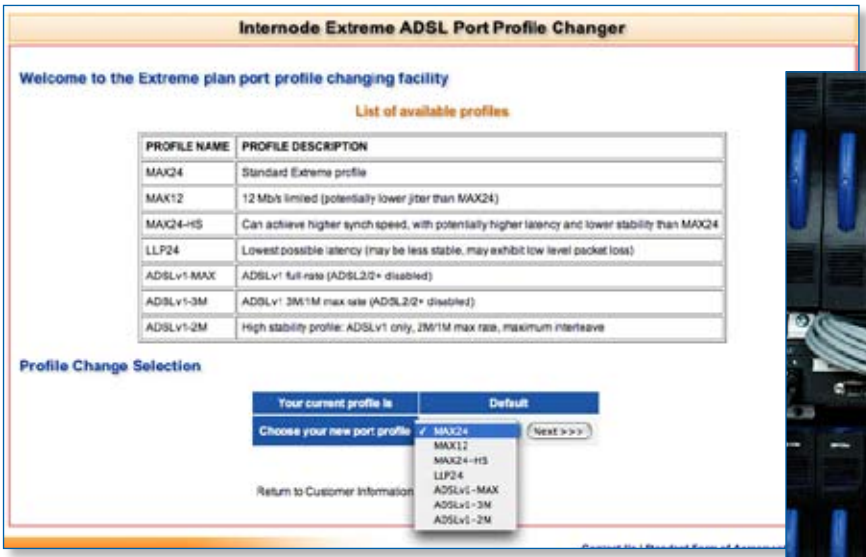
One modem that turned in a bad performance last year was Draytek's Vigor 2800. When we originally tested it, Draytek said its poor performance was due to beta firmware. This year, we had trouble getting the modem to connect at all to our test DSLAM (which was locked to use ADSL2+ only). It turned out that Draytek had sent us a modem with firmware that only worked on ADSL1 (despite, confusingly, having settings for ADSL2 and 2+ in the interface).

We asked what firmware to upgrade to and we were given five different firmware versions, though Draytek couldn't tell us which would be most suitable firmware to use with the Ericsson DSLAMs. After trial and error, we eventually found a firmware version that would allow us to connect (2.6.5-D1621), but even though line sync speeds were good (up to 21.2Mbit/s) actual throughput didn't go faster than 11Mbit/s in any of our tests.

We also observed problems with the LevelOne modems. Although they achieved good throughput speeds, they repeatedly dropped the TCP connection mid-transfer. At other times they would successfully get through a file transfer. Normally we would be hesitant to say this was definitely due to a problem with the modems, but in the case of this test, it happened with both models of the LevelOne modem we tested, and not any of the other modems. Because we used a rock-solid dedicated FTP server, clean copper lines and a consistent test method, we feel confident in saying that

> MOST PEOPLE PROBABLY NEVER THINK TO CHECK IF THERE'S A NEWER VERSION OF THEIR MODEM'S FIRMWARE

Zyxel P2602HWL: improved performance over last year's results.



Internode and other ISPs let you change the settings of your DSLAM port online via their web site.

A batch of Internode's Ericsson DSLAMs at a Telstra exchange. The spindly yellow cable is the fibre-optic feed.

Give your DSLAM a tweak

Did you know you can probably tweak your ISP's DSLAM to get extra speed from your connection?

Some ADSL2+ ISPs let you choose "line profiles" for your connection. This is something that Telstra-based ISPs can't do; Telstra doesn't allow customers (or even ISPs) to modify any DSLAM settings.

We did all our formal modem testing using the default Internode line profile MAX24 — replicating what the majority of customers use.

But to satisfy our interest, we tweaked a few settings here and there — what we discovered was staggering: huge performance improvements are made by making tiny changes to settings. (NB: Your mileage may vary depending on the quality of your phone line.)

There are two key settings that can be changed on a DSLAM: **Target SNR** — tells the modem to aim for a signal-to-noise margin of a certain amount. Expressed in decibels, it's the difference between the loudness of the modem's signal and the loudness of background noise on the line. For each 3dB, the difference doubles, making the connection more resilient to spikes in line noise, but also reducing the maximum attainable line speed. Internode offers a line profile for gamers called "MAX24 — HS" which shaves target SNR right down. People with very good phone lines close to the exchange will get a faster connection. But if there is fluctuating line noise, the connection could be unstable.

Interleaving — mixes the packets of data together, along with error-correction data, so if line noise causes packets to corrupt, your modem can recreate them (without the packets having to be retransmitted). Interleaving is described in milliseconds — eg. 4ms of interleaving means 4ms worth of packets mixed together.

We discovered during testing that interleaving can considerably reduce modem performance. For example, the Cisco 877W modem, which clocked in at the leading speed of 19.1Mbit/s actual throughput with interleaving disabled, lost a full 33 per cent of its speed when we switched interleaving on at the DSLAM. (It dropped back to 19th place at an unimpressive 12.6Mbit/s.) Given Cisco's rep for specing its boxes up with enough grunt to handle features being enabled (without performance degradation), this was quite surprising — perhaps a sign of immaturity in the 877W's firmware.

Other modems that suffered the most with interleaving on were LevelOne WBR-3407A (29% drop in performance), Dynalink RTA1335 (27%), Dynalink RTA1046VW (25%) and Draytek Vigor 2800VG (24%).

On average, having interleaving enabled saw performance drop by 17 per cent. However, Internode managing director Simon Hackett says that interleaving plays a very important role on sub-optimal phone lines. "Any packet loss at all can have a huge effect on performance," he says. "When a phone rings, it's a 50 volt signal heading down the line; at a low frequency that's not supposed to interfere with ADSL, but it does produce a broad spectrum impulse spike. Interleaving does exactly what CD players do; takes data and spreads it over time so if there's a short spike in line noise (like a scratch on a CD) a number of corrupted packets can be recreated on the fly."

Indeed, one modem in the test, the low-end Zyxel Prestige 660HW, performed considerably better with interleaving switched on, going from a mediocre 10.5Mbit/s to eighth-fastest — 14.5Mbit/s throughput (a 38% boost).

Because interleaving combines a few milliseconds' worth of data together, which must be decoded at the other end, it affects ping time. This can be a downside for gamers who value fast response in their games.

Given that small settings can make such a major difference, getting the most from your ADSL2+ connection is easiest if you sign up with an ISP — such as iiNet and Internode and others — that have selectable profiles (usually on their web site once you have logged in to your account settings.)

Wireless: an ADSL2+ bottleneck

Our testing showed that ADSL2+ modems with interleaving turned on would hit a peak speed of about 15.2Mbit/s. But with interleaving turned off and a finely tuned signal-to-noise ratio, the best modem (Cisco 877W) edged up to a top speed of 19.1Mbit/s real throughput. But can the 802.11g wireless built in to many of the "all in one" modems actually transmit that fast? The answer, unfortunately, is no. The fastest modem we tested was Dynalink RTA1046VW, achieving an average transfer speed of 15.13Mbit/s. To its credit, sitting 30cm from the router, we were able to get a 21.5Mbit/s transfer rate, but, of course, if you were sitting that close, there would be no problem with using an Ethernet cable.

The real test was our "position 3" which was about 15 metres from the transmitter and which required the signal to get through wood and metal partitions, office equipment, people and other office miscellanea. In this test, the Draytek Vigor 2800 achieved 9.8Mbit/s, but the close-range champ, the Cisco 877W, achieved a measley 4% of that speed — just 436Kbit/s.

The rather obvious conclusion that can be drawn from these results is that if you are able to get a decent ADSL2+ throughput at home, Ethernet is the way to go. When 802.11n arrives next year, the problem will hopefully be resolved. Until then, it's probably a compromise between wireless convenience and throughput speed.

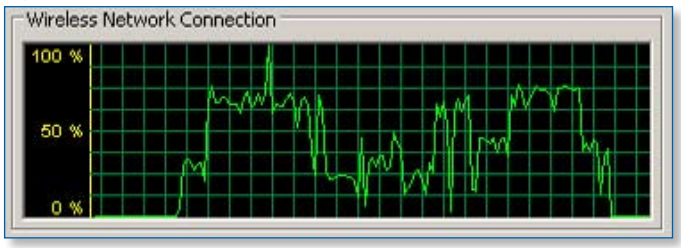
One very odd anomaly that we observed with quite a few of the modems was a very poor transfer rate at close (30cm) range. The affected modems were Belkin F1PI241EGau, both Zyxel models and the LevelOne WBR-3407A.

TOP 5 wireless

1 Dynalink RTA1046VW (15.13Mbit/s)
2 Draytek Vigor 2800VG (14.97Mbit/s)
3 Billion 7404VGP (13.9Mbit/s)
4 Netcomm NB9W (12.81Mbit/s)
5 Thomson Speedtouch ST780WL (12.76Mbit/s)

Wireless modems by average transfer rate.

The trouble with testing wireless: big fluctuations can occur during testing. We repeated the tests at each position three times and then averaged results.



TOP 5 mid-range

1 D-LINK DVA-G3340S (17.50 Mbit/s)
2 Linksys WAG54GP2 (15.95 Mbit/s)
3 Dynalink RTA1046VW (15.37 Mbit/s)
4 Billion 7404VGP (14.62 Mbit/s)
5 DrayTek Vigor2800VG (13.73 Mbit/s)

Top 5 modems at medium 10m range.

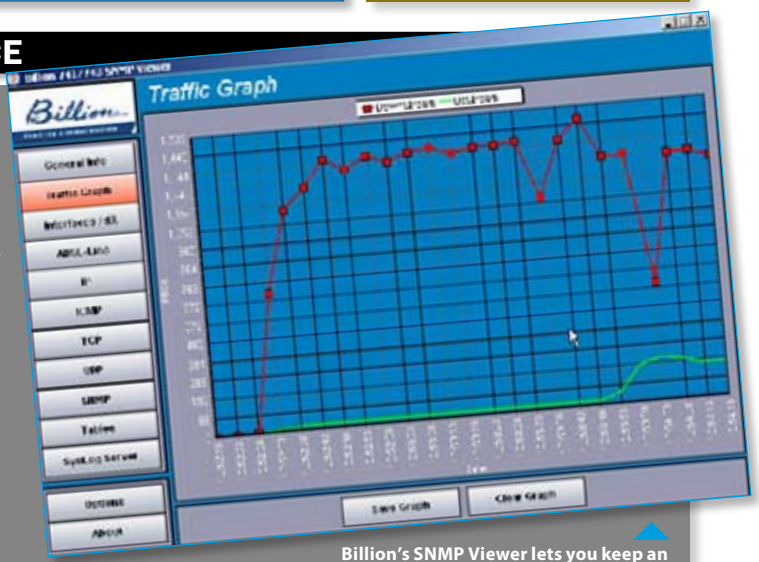
MONITOR YOUR MODEM'S PERFORMANCE

Keeping an eye on your modem's performance isn't always easy: while you can usually get some statistics on sync speed from the modem's web interface, you can't usually get information on throughput. Collecting info on your PC's actual throughput isn't always easy either if you have multiple downloads going at once.

One way of doing it is to use Simple Network Management Protocol (SNMP), which is a way to gather information from your router and display it on your PC. You can monitor all sorts of interesting things like the signal-to-noise ratio, which, if fluctuating, could indicate a problem with your line.

Most home modems/routers do support SNMP (with varying degrees of completeness) and there are lots of how-to guides available online. Some of the more popular programs are SNMP Traffic Grapher, PRTG and MRTG.

However, Australian enthusiasts have made utilities for some specific brands of modem/router that make it a piece of cake to keep an eye on what's happening. Billion routers in particular have a utility available called "Billion SNMP Viewer". There was no homepage for it at the time this article was written, but search Google and you'll turn up links to it at Whirlpool (*http://whirlpool.net.au*) soon enough.



Billion's SNMP Viewer lets you keep an eye on what's happening on your modem.

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Modem interfaces: good and bad

Routers are phenomenally complex combinations of hardware and software, and few people fully understand all the possible settings.

But there are some settings that most people will bump into sooner or later, whether they like it or not. A modem/router with a good web-based admin interface can be the difference between you spending most of Sunday afternoon reading through lengthy Wikipedia articles on the ins-and-outs of port forwarding (or simply making a simple change and getting on with it).

Although most of the modem/routers we looked at still fit into the category of "so complex they make your eyes water", there were some units that impressed us with improvements in ease-of-use. Of course, for complex users, wizards can get in the way if you do know what you're doing. The Thomson Speedtouch 780WL struck an excellent balance of ease of use and straightforward configuration. It shows a visual map of your home network that changes when you plug in a new computer or connect a phone to one of the modem's VoIP sockets. It senses the computer's network name so that you don't have to guess which computer is which by IP address. Then, if you need to set up a port-forwarding rule, you click on the computer and select from a very long predefined list of applications and let the 780WL sort out which ports to forward. You can still define your own ports manually.

The Billion 7404VGP also has an excellent feature that makes VoIP a bigger cost-saver and more configurable. An on-screen "dial plan" builder allows you to specify how certain types of numbers should be connected.

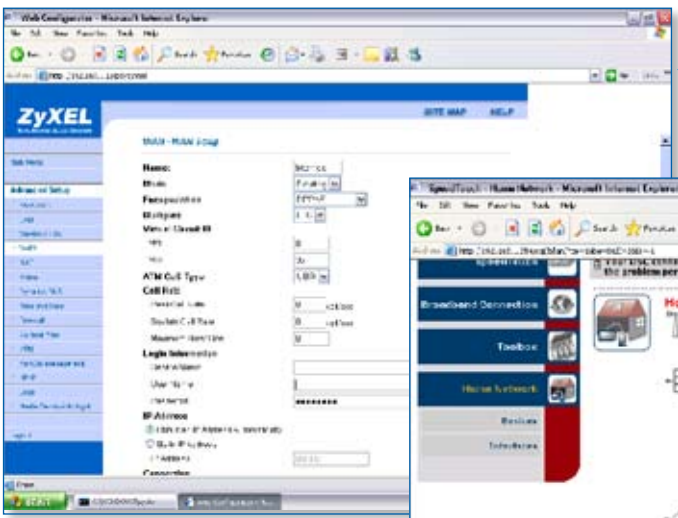
For example, if you are calling a 13 number which connects you to the nearest branch of a company, you can specify on the modem you want those numbers to actually be dialled via your Telstra landline so your location is sensed correctly. You'll never be incorrectly connected to the Pizza Hut in Ayers Rock again.

Likewise, some VoIP providers have good rates to certain countries, but not others. Dial plans let you route calls to the USA via one provider and calls to Hong Kong via another, for example.

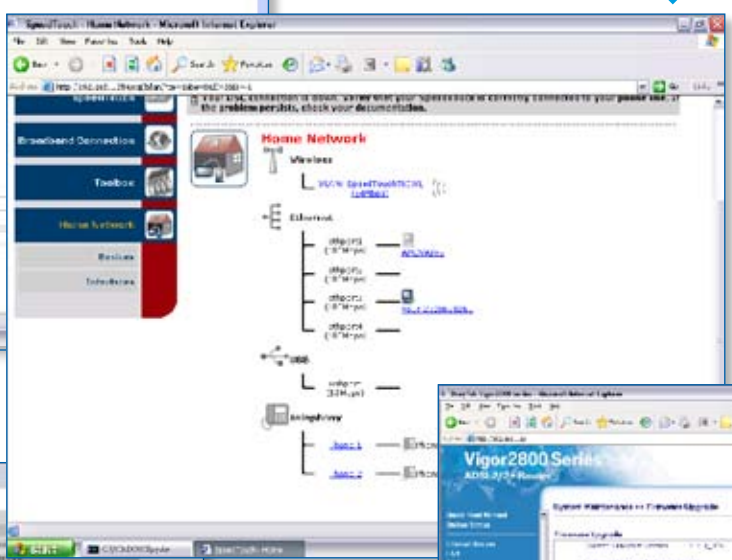
Some other modems and ATAs have dial plans, but setting them up involves learning a complex language and writing cryptic strings of letters and numbers. The Billion interface makes this a visual, menu-driven process.

We also saw some pretty bad interfaces. Zyxel seemed to think that every possible configuration option should be visible to the end user, including ATM peak cell rate, sustain cell rate and maximum burst size. Those *incredibly* advanced settings were on the same page as the one where you put in your ISP username and password. That's asking for trouble.

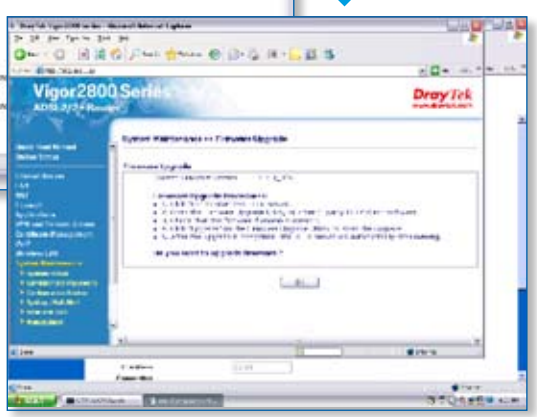
And we were unimpressed with the Draytek Vigor 2800, which unfortunately required a firmware upgrade. You can't do it via the web interface like all the other modems. You have to start the TFTP server in the modem, then use a TFTP client to upload a firmware file. That method was cool in the 1990s, but is a major pain in the arse nowadays.



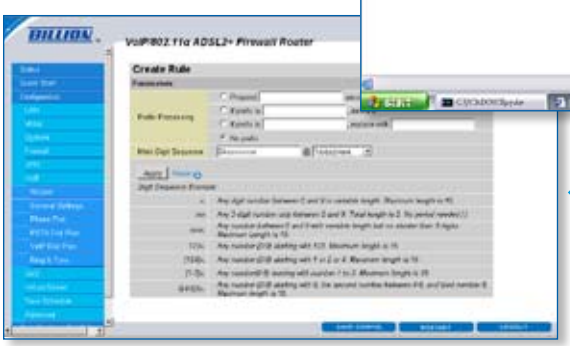
If you have a PhD in network engineering, you'll love Zyxel's configuration interface.



The Speedtouch 780WL makes it easy to see devices connected to your modem and make config changes.



To firmware upgrade the Draytek Vigor, simply start the TFTP server on the modem, download a TFTP client, figure out how to use it, download the firmware file and upload it to the modem via TFTP. Easy!



With a dial-plan interface you can route mobile calls via PSTN to take advantage of capped call rates.

The results

With such variance in performance at different line lengths, it's difficult to say that one or two modems are the best of the bunch. Indeed, if you know your line length, the best thing you could do would be to look at the performance graphs and make your own decision.

However, we did look at what modems stood out as having good performance overall. To determine this, we averaged the modems' performance at 1km and 3.5km to get a sense of their ADSL2+ throughput at the most common line lengths. We didn't include the 6km test results in our averaging because it is at the outer fringe of what is practical for an ADSL connection and the low results across all modems would unnecessarily distort the average.

ALL-IN-ONES

In the all-in-one category, we also considered which modems sustained good wireless performance over all three test positions.

In all-in-ones, the Billion 7404VGP, the successor to last year's winner, the 7402G, came out on top when looking at average ADSL2+ and wireless performance. It was the second-fastest ADSL modem on average (losing out by a thin margin to Billion's budget model, the 7300G), but, impressively, it had the third-fastest wireless performance. Few modems in the roundup excelled in both ADSL2+ and wireless.

We also highly recommend the Netcomm's NB9W in the all-in-one category and the Dynalink RTA1046VW. Both of them had good ADSL2+ speed but excellent wireless speed.

BASIC MODEM ROUTERS

Billion snags Editor's Choice in the budget category as well: the 7300G had the fastest average ADSL2+ performance. (Oddly, at the 6km line length it performed worst, so it's probably not a good choice if you suspect you live far away from your phone exchange.)

We also highly recommend the iConnectAccess624, which had the second-fastest throughput in budget modems, and seventh-fastest across all the modems. abc

ADSL2+ SPEED TESTS

All these tests were done using Internode's default customer profile MAX24, which has interleaving enabled for resilience against line noise and a fairly wide signal-to-noise target. Bear in mind some modems performed much worse with interleaving on.

MODEL	1km (0–16)	3.5km (0–10)	6km (0–5)
Belkin F1PI241EGau	14.96	6.50	1.82
Billion BIPAC7300G	14.89	8.78	0.30
Billion BIPAC7404VGP	14.63	8.10	1.53
Cisco 877W	12.60	8.53	1.90
D-LINK DSL-504T	14.56	6.35	1.57
D-LINK DVA-G3340S	14.25	6.25	1.24
DrayTek Vigor2800VG	8.45	6.77	1.28
Dynalink RTA1046VW	13.88	7.07	1.49
Dynalink RTA1335	11.74	7.07	1.39
LevelOne FBR-1416A (v2)	13.32	6.37	1.67
LevelOne WBR-3407A (v2)	10.74	6.63	1.90
Linksys AG241	14.12	6.37	1.61
Linksys WAG54GP2	14.63	6.50	1.78
NetComm NB5Plus4	14.37	6.50	1.82
NetComm NB9W	14.12	6.92	1.58
NETGEAR DG834	13.21	6.77	1.90
OPEN Networks iConnectAccess624	14.50	6.63	0.74
OPEN Networks iConnectAccess624W	15.17	6.50	0.58
Siemens Speedstream 6520	15.17	6.77	1.78
Thomson Speedtouch ST546	10.34	6.77	1.52
Thomson Speedtouch ST780WL	13.43	6.77	1.49
Zyxel Prestige 2602HWL-61C	13.54	6.48	1.74
Zyxel Prestige 660HW	14.50	6.30	1.80

802.11G WIRELESS SPEED TESTS

We connected a server by Ethernet to each modem and used the iperf software to stream data to an Intel Centrino certified laptop in three standard test positions. The fastest speed we recorded from any of the modems was from the Dynalink RTA1046VW at 21.51Mbit/s.

MODEL	CLOSE (30cm) (0–22)	MEDIUM (10m) (0–18)	LONG (15m) (0–10)
Belkin F1PI241EGau	0.97	9.48	1.35
Billion BIPAC7300G	21.33	11.72	3.58
Billion BIPAC7404VGP	21.46	14.62	5.63
Cisco 877W	20.34	9.86	0.44
D-LINK DVA-G3340S	15.39	17.50	3.18
DrayTek Vigor2800VG	21.36	13.73	9.81
Dynalink RTA1046VW	21.51	15.37	8.52
LevelOne WBR-3407A (v2)	0.88	12.92	0.87
Linksys WAG54GP2	14.29	15.95	0.72
NetComm NB9W21.37	21.37	12.44	4.63
OPEN Networks iConnectAccess624W	13.38	13.12	1.98
Siemens Speedstream 6520	12.58	12.07	0.99
Thomson Speedtouch ST780WL	20.51	11.68	6.07
Zyxel Prestige 2602HWL-61C	1.12	11.43	2.81
Zyxel Prestige 660HW	1.01	13.61	3.58

ADSL2+ UNDER OPTIMAL CONDITIONS

If you live 1km from a phone exchange and have a very good quality line, these are the sorts of results you could get. We got these results by shaving signal-to-noise ratio right back and turning off interleaving altogether. Note the Cisco's dramatic improvement in performance, soaring from 12.6Mbit/s (with interleaving on) to 19.05Mbit/s (with it switched off).

MODEL	1km (LOW SNR, NO INTERLEAVE)
	0 – 20
Cisco 877W	19.05
Dynalink RTA1046VW	18.62
OPEN Networks iConnectAccess624	18.62
OPEN Networks iConnectAccess624W	18.41
Siemens Speedstream 6520	18.20
NetComm NB9W	18.20
Linksys WAG54GP2	17.81
Billion BIPAC7404VGP	17.62
Belkin F1PI241EGau	17.43
D-LINK DSL-504T	17.25
D-LINK DVA-G3340S	17.25
Linksys AG241	17.25
NetComm NB5Plus4	17.25
LevelOne FBR-1416A (v2)	16.22
Thomson Speedtouch ST780WL	16.06
Dynalink RTA1335	16.06
Billion BIPAC7300G	15.91
NETGEAR DG834	15.91
Zyxel Prestige 2602HWL-61C	15.91
LevelOne WBR-3407A (v2)	15.17
Thomson Speedtouch ST546	11.95
DrayTek Vigor2800VG	11.07
Zyxel Prestige 660HW	10.50

AVERAGE ADSL2+ SPEED

These results are the average of the 1km and 3.5km tests, to give an indication of which modems perform best over common line-lengths. Billion is the clear speed winner here.

MODEL	AVERAGE OF 1 & 3.5km
	0 – 12
Billion BIPAC7300G	11.84
Billion BIPAC7404VGP	11.36
Siemens Speedstream 6520	10.97
OPEN Networks iConnectAccess624W	10.84
Belkin F1PI241EGau	10.73
Cisco 877W	10.57
OPEN Networks iConnectAccess624	10.57
Linksys WAG54GP2	10.56
NetComm NB9W	10.52
Dynalink RTA1046VW	10.48
D-LINK DSL-504T	10.46
NetComm NB5Plus4	10.44
Zyxel Prestige 660HW	10.40
D-LINK DVA-G3340S	10.25
Linksys AG241	10.25
Thomson Speedtouch ST780WL	10.10
Zyxel Prestige 2602HWL-61C	10.01
NETGEAR DG834	9.99
LevelOne FBR-1416A (v2)	9.85
Dynalink RTA1335	9.41
LevelOne WBR-3407A (v2)	8.69
Thomson Speedtouch ST546	8.55
DrayTek Vigor2800VG	7.61

AVERAGE WIRELESS SPEED

This graph averages the speeds achieved by each modem across all three test locations. Dynalink's high-end all-in-one unit takes out the speed crown for average throughput across all three distances: a very impressive result. Draytek Vigor2800's result is also stellar — it's just a shame that its ADSL2+ performance was so lousy.

MODEL	AVERAGE SPEED
	0 – 16
Dynalink RTA1046VW	15.13
DrayTek Vigor2800VG	14.97
Billion BIPAC7404VGP	13.90
NetComm NB9W	12.81
Thomson Speedtouch ST780WL	12.76
Billion 7300G	12.21
D-LINK DVA-G3340S	12.03
Linksys WAG54GP2	10.32
Cisco 877W	10.21
OPEN Networks iConnectAccess624W	9.49
Siemens Speedstream 6520	8.55
Zyxel Prestige 660HW	6.06
Zyxel Prestige 2602HWL-61C	5.12
LevelOne WBR-3407A (v2)	4.89
Belkin F1PI241EGau	3.94

	BILLION BIPAC7300G	D-LINK DSL-504T	DYNALINK RTA1335	LEVEL ONE FBR-1416A (V2)	LEVEL ONE WBR-3407A (V2)	LINKSYS AG241
TYPE	Basic modem/router	Basic modem/router	Basic modem/router	Basic modem/router	Basic modem/router	Basic modem/router
Chipset	TRENDCHIP TC3162	Texas Instruments	Broadcom	Texas Instruments	Texas Instruments	Texas Instruments
LOCAL NETWORKING						
Ethernet ports	4	4	4	4	4	4
Ethernet port speed	100	100	100	100	100	100
802.11g	Yes	No	No	No	Yes	No
WEP	Yes	No	No	No	Yes	No
WPA	Yes	No	No	No	Yes	No
WPA2	No	No	No	No	Yes	No
Bridge mode	Yes	Yes	Yes	No	Yes	Yes
QUALITY OF SERVICE						
QoS by traffic type (port)	Yes	No	Yes	No	No	Yes
Throttling by wired IP	Yes	No	No	No	No	No
Throttling by wireless IP	Yes	No	No	No	No	No
Throttling by E'net jack	No	No	No	No	No	No
QoS by Ethernet jack	No	No	Yes	No	No	No
VOIP FEATURES						
Phone handset ports	No	No	No	No	No	No
Phone line port	No	No	No	No	No	No
PSTN passthrough	No	No	No	No	No	No
Simultaneous VoIP calls	No	No	No	No	No	No
VoIP providers	No	No	No	No	No	No
NETWORK MGT						
UPnP	Yes	Yes	Yes	Yes	Yes	Yes
User def. port fwd slots	20	16	32	12	12	25
SNMP support	Yes	Yes	No	Yes	Yes	Yes
SNMP software bundled	Downloadable	No	No	No	No	No
EXTRAS						
Server for USB printers	No	No	No	No	No	No
NAS server - USB storage	No	No	No	No	No	No
DDNS updating	Yes	Yes	Yes	Yes	Yes	Yes
WARRANTY						
Warranty - months	24	36	12	36	36	36
Online forum	www.billion.com.au	No	No	www.levelone.com.au	www.levelone.com.au	No
PERFORMANCE						
Av. ADSL2+ speed*	11.84	10.46	9.41	9.85	8.69	10.25
ADSL2+ Speed rank*	1	11	20	19	21	15
Av. wireless speed**	12.21	N/A	N/A	N/A	4.89	N/A
Wireless speed rank**	6	N/A	N/A	N/A	14	N/A

✔	Amazing at 3.5km; wireless performance.	Quite good ADSL2+ performance.	32 port forwarding slots.	Good warranty.	Good warranty.	Three-year warranty.
✖	Worst performance at 6km.	Made an annoying high-pitched sound.	Average ADSL2+ speed.	Bad ADSL2+ and wireless; drop outs.	Bad ADSL2+ and wireless; drop outs.	Average ADSL2+; annoying squeal.

*** Based on average of 1km and 3km results ** Average of all wireless distances**

NETCOMM NB5PLUS4	NETGEAR DG834 ADSL FR	OPEN NETWORKS ICONNECTACCESS624	THOMSON SPEEDTOUCH ST546	ZYXEL PRESTIGE 660HW	BELKIN F1PI241EGAU	
Basic modem/router	Basic modem/router	Basic modem/router	Basic modem/router	Basic modem/router	All-in-one	**TYPE**
Texas Instruments	Texas Instruments	Texas Instruments	Broadcom	Texas Instruments	AG241	**Chipset**
						LOCAL NETWORKING
4	4	4	4	4	4	**Ethernet ports**
100	100	100	100	100	100	**Ethernet port speed**
No	Yes	No	No	Yes	Yes	**802.11g**
No	No	No	No	Yes	Yes	**WEP**
No	No	No	No	Yes	Yes	**WPA**
No	No	No	No	No	No	**WPA2**
Yes	No	Yes	Yes	Yes	Yes	**Bridge mode**
						QUALITY OF SERVICE
Yes	No	Yes	Yes	Yes	Yes	**QoS by traffic type (port)**
No	No	Yes	Yes (RT traffic)	Yes	Yes	**Throttling by wired IP**
No	No	No	Yes (RT/WMM traffic)	Yes	Yes	**Throttling by wireless IP**
No	No	Yes	Yes	Yes	No	**Throttling by E'net jack**
Yes	No	No	Yes	Yes	No	**QoS by Ethernet jack**
						VOIP FEATURES
No	No	No	No	No	2	**Phone handset ports**
No	No	No	No	No	Yes	**Phone line port**
No	No	No	No	No	Yes	**PSTN passthrough**
No	No	No	No	No	3	**Simultaneous VoIP calls**
No	No	No	No	No	1	**VoIP providers**
						NETWORK MGT
Yes	Yes	Yes	Yes	Yes	Yes	**UPnP**
20	Unlimited	Unlimited	32	Yes	20	**User def. port fwd slots**
Yes	Yes	Yes	Yes	Yes	Yes	**SNMP support**
No	No	No	No	Yes	No	**SNMP software bundled**
						EXTRAS
No	No	No	No	No	No	**Server for USB printers**
No	No	No	No	No	No	**NAS server - USB storage**
Yes	Yes	Yes	Yes	Yes	Yes	**DDNS updating**
						WARRANTY
24	24	12	12	24	24	**Warranty - months**
No	forum1.netgear.com	No	No	www.zyxel.com.au	No	**Online forum**
						PERFORMANCE
10.44	9.99	10.57	8.55	10.40	10.73	**Av. ADSL2+ speed***
12	18	7	22	13	5	**ADSL2+ Speed rank***
N/A	N/A	N/A	N/A	6.06	3.94	**Av. wireless speed****
N/A	N/A	N/A	N/A	12	15	**Wireless speed rank****

Good warranty terms; OK ADSL2+. Faceplate status lights difficult to see.	Equal best at 6km line-length. Average ADSL2+ speed overall.	Excellent ADSL2+ performance. Bad performance at 6km.	Seventh-fastest at 3.5km. Suffered with interleaving on.	Two-year warranty. Poor ADSL2+; poor wireless.	Good ADSL2+ speed. Poor wireless speed.	✔ ✖

BILLION BIPAC7404VGP	CISCO 877W	DRAYTEK VIGOR2800VG	DYNALINK RTA 1046VW	LINKSYS WAG54GP2	NETCOMM NB9W	
All-in-one	All-in-one	All-in-one	All-in-one	All-in-one	All-in-one	**TYPE**
Conexant	Alcatel (STMI)	Globespan Virata	Broadcom	Texas Instruments	Broadcom	**Chipset**
						LOCAL NETWORKING
4	4	4	4	4	4	**Ethernet ports**
100	100	100	100	100	100	**Ethernet port speed**
Yes	Yes	Yes	Yes	Yes	Yes	**802.11g**
Yes	Yes	Yes	Yes	Yes	Yes	**WEP**
Yes	Yes	Yes	Yes	Yes	Yes	**WPA**
Yes	No	Yes	Yes	No	Yes	**WPA2**
Yes	Yes	Yes	Yes	Yes	Yes	**Bridge mode**
						QUALITY OF SERVICE
Yes	Yes	Yes	Yes	Yes	Yes	**QoS by traffic type (port)**
Yes	Yes	Yes	No	No	No	**Throttling by wired IP**
Yes	Yes	Yes	No	No	No	**Throttling by wireless IP**
Yes	Yes	Yes	No	No	No	**Throttling by E'net jack**
Yes	Yes	No	Yes	Yes	Yes	**QoS by Ethernet jack**
						VOIP FEATURES
2	No	2	2	2	2	**Phone handset ports**
Yes	No	No	Yes	No	Yes	**Phone line port**
Yes	No	No	1	Yes	Yes	**PSTN passthrough**
2	No	2	4	4	2	**Simultaneous VoIP calls**
2	No	6	1	2	1	**VoIP providers**
						NETWORK MGT
Yes	Yes	Yes	Yes	Yes	Yes	**UPnP**
Unlimited	N/A	10	32	25	12	**User def. port fwd slots**
Yes	Yes	Yes	Yes	Yes	Yes	**SNMP support**
Downloadable	Yes	No	No	No	No	**SNMP software bundled**
						EXTRAS
No	No	Yes	No	No	No	**Server for USB printers**
No	No	No	No	No	No	**NAS server - USB storage**
Yes	Yes	Yes	Yes	Yes	Yes	**DDNS updating**
						WARRANTY
24	12	36	12	36	36	**Warranty - months**
www.billion.com.au	No	www.draytek.com.au	No	No	No	**Online forum**
						PERFORMANCE
11.36	10.57	7.61	10.48	10.56	10.52	**Av. ADSL2+ speed***
2	6	23	10	8	9	**ADSL2+ Speed rank***
13.90	10.21	14.97	15.13	10.32	12.81	**Av. wireless speed****
3	9	2	1	8	4	**Wireless speed rank****

Good performance at all line-lengths. Wireless only third fastest.	Good ADSL2+ and wireless. Suffered massively with interleaving on.	Inbuilt print server; great wireless. Worst ADSL2+ performance.	Best wireless; good ADSL2+. 12-month warranty.	"Top 10" ADSL2+ performance. No psm passthroughs for VOIP	"Top 10" ADSL2+ and excellent wireless. Only 12 port forward slots	✔ ✖

*** Based on average of 1km and 3km results ** Average of all wireless distances**

	OPEN NETWORKS ICONNECTACCESS624W	SPEEDSTREAM 6520	THOMSON SPEEDTOUCH ST780WL	ZYXEL PRESTIGE 2602HWL-61C	ZYXEL PRESTIGE 660HW
TYPE	All-in-one	All-in-one	All-in-one	All-in-one	All-in-one
Chipset	Texas Instruments	Texas Instruments	Broadcom	Texas Instruments	Texas Instruments
LOCAL NETWORKING					
Ethernet ports	4	4	4	4	4
Ethernet port speed	100	100	100	100	100
802.11g	Yes	Yes	Yes	Yes	Yes
WEP	Yes	Yes	Yes	Yes	Yes
WPA	Yes	Yes	Yes	Yes	Yes
WPA2	No	Yes	Yes	No	Yes
Bridge mode	Yes	Yes	Yes	Yes	Yes
QUALITY OF SERVICE					
QoS by traffic type (port)	Yes	No	Yes	Yes	Yes
Throttling by wired IP	Yes	No	Yes (RT traffic)	Yes	Yes
Throttling by wireless IP	Yes	No	Yes (RT/WMM traffic)	Yes	Yes
Throttling by E'net jack	Yes	No	Yes	Yes	Yes
QoS by Ethernet jack	No	No	Yes	Yes	Yes
VOIP FEATURES					
Phone handset ports	No	No	2	2	2
Phone line port	No	No	Yes	Yes	Yes
PSTN passthrough	No	No	Yes	Yes	Yes
Simultaneous VoIP calls	No	No	4	2	2
VoIP providers	No	No	1	2	2
NETWORK MGT					
UPnP	Yes	Yes	Yes	Yes	Yes
User def. port fwd slots	Unlimited	20	32	Yes	16
SNMP support	Yes	Yes	Yes	Yes	Yes
SNMP software bundled	No	No	No	Yes	No
EXTRAS					
Server for USB printers	No	No	No	No	No
NAS server - USB storage	No	No	No	No	No
DDNS updating	Yes	No	Yes	Yes	Yes
WARRANTY					
Warranty - months	12	24	12	24	36
Online forum	No	forum1.netgear.com	No	www.zyxel.com.au	No
PERFORMANCE					
Av. ADSL2+ speed*	10.84	10.97	10.10	10.01	10.25
ADSL2+ Speed rank*	4	3	16	17	14
Av. wireless speed**	9.49	8.55	12.76	5.12	12.03
Wireless speed rank**	10	11	5	13	7

✔	Excellent ADSL2+ performance.	Good ADSL2+ speed.	Well thought-out user interface; good wireless .	Two-year warranty.	Good wireless performance.
✖	Bad performance at 6km.	Average wireless speed.	Average ADSL2+ speed.	Poor ADSL2+; poor wireless.	Some bugs in user interface.